

***A Report on***  
**Rural Technology Action Group (RuTAG), IIT Delhi**

**Regional Workshop in Bhuj, Kutch, Gujarat**

**in Collaboration with CfP and Khamir**

**held at**

**Khamir, Lakhond Crossroads - Kukma Road, Behind BMCB Social City, Post  
Village Kukma, Bhuj 370105, India**

**and**

**Mr. Ramju Bhai Kumbhar Residence, Laakhurai Crossroads, Suralbhit road, Bhuj –  
Kutch 370001, India**

**on**

**April 25 and 26, 2022**



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## Preamble

RuTAG IIT Delhi conducted a regional workshop during April 25 and 26, 2022 in collaboration with CfP and Khamir at Bhuj, Gujarat. The program was attended by around 130 participants, which included Prof. S. K. Saha, Professor, Dept. of Mechanical Engineering, IIT Delhi, Coordinator, RuTAG IIT Delhi, Prof. M. R. Ravi, Professor Dept. of Mechanical Engineering, IIT Delhi, Co-coordinator, RuTAG IIT Delhi, Prof. R. Chattopadhyay, Professor, Dept. of Textile Engineering, IIT Delhi, Prof. Bhupinder Godara, Professor, Dept. of Mechanical Engineering, IIT Delhi, Mr. Davinder Pal Singh and Mr. Yashwant Prasad, Project Engineer, RuTAG IIT Delhi, Ms. Sushma Iyengar, Co-founder of CfP and President of Khamir, Mr. Ghatit Laheru, Director, Khamir, Bhuj, Mr. Manoj Mishra, Executive Director, Sahjeevan, Mr. Shoryamoy Das, CfP and Khamir, Ms. Gunjan Satija, CfP, Delhi, Mr. Harish Hurmade, Mr. Dipesh Buch, Mr. Pratap Chavda and Mr. Hemal Jobanputra, Khamir, Bhuj, Mr. Vishnu Gour, Sahjeevan, Bhuj, Ms. Bhachi Ben Rabari and Ms. Deval Ben Karamssi Rabari, spinners, Bhuj, Mr. Ramjubhai Kumbhar and Mr. Amad Ramju, potters, Bhuj and other NGO participants, institute representatives, industrialists, government body representatives, potters, herders, spinners and weavers.



### Day 1: April 25, 2022

#### 1. Inauguration session (April 24, 2022)

Ms. Gunjan Satija coordinated the inaugural session, followed by Mr. Yashwant Prasad. The workshop started with the lighting of the lamp by Prof. S. K. Saha and artisans (Fig. 1).



Figure 1 Inauguration of the workshop

## 1.1 Welcome and introduction of CfP

Ms. Sushma Iyengar welcomed the delegates and participants of the workshop (Fig. 2). She thanked RuTAG IIT Delhi team for conducting the workshop on *Desi* wool processing and pottery kiln in collaboration with CfP and Khamir in Bhuj. She briefly explained the work of CfP to enhance pastoralist livelihood security, promote research to support pastoral systems, and educate society on pastoralism.



Figure 2 Ms. Sushma Iyengar welcoming participants



Figure 3 Prof. S. K. Saha Welcoming Participants

## 1.2 Welcome to the workshop

Prof. S. K. Saha welcomed the participants and briefly explained the workshop's agenda (Fig. 3). He explained the mechanism and role of RuTAG IIT Delhi in science and technology interventions for rural India. He offered his sincere thanks for the efforts of CfP and Khamir in hosting and coordinating the workshop. He also thanked all the participants.

This session was followed by the introduction of the participants (Fig. 4). Participants from various NGOs, institutes, and organizations introduced themselves and their organizations.



*Figure 4 Introduction by participants*

### **1.3 About RuTAG IIT Delhi**

Prof. S. K. Saha outlined several completed and ongoing projects of RuTAG IIT Delhi. He gave a brief explanation on Animal Driven Gear Box, Bullock Driven Tractor (old and new), Treadle Pump, Tulsi Mala making Device, Sheep Hair Shearing Device, Groundwater level measuring device, and Carpet related machines developed by IIT Delhi. He also mentioned the objectives and mandate of the RuTAG programs. Prof. M. R. Ravi introduced participants with his work on the improvement of various furnaces and their implementation in villages across India (Fig. 5). Prof. S. K. Saha also mentioned the difficulties in the adaptation and penetration of technologies in the field.



*Figure 5 Prof. S. K. Saha (behind) and Prof. M. R. Ravi (front) presenting*

## 2 Session – 2: Development, demonstration, and adaptation of carding machine for coarse desi wool fibres

### 2.1 Demonstration of carding machine

Prof. R. Chattopadhyay presented the design of the first prototype of carding machine developed by RuTAG IIT Delhi (Fig. 6). Initially, he explained the problem background and requirement of small carding machines for the small-scale and decentralized rural sector. Then, he explained the importance of carding in wool processing. He mentioned that 2<sup>nd</sup> hand old carding machines available in the market are outdated. These machines are not suitable for processing as they are expensive, occupy large space, and are difficult to maintain, repair, and operate. The new machine has been designed for ease of maintenance and operation, and efforts were made to make it user-friendly such that it could be operable by both men and women. Many functional elements of carding machine were eliminated to reduce the cost. Higher version of the design will incorporate the other essential elements as per requirement. Wool must be cleaned before carding from impurities like thrones, dust, sweat, urine, etc., to take out maximum value from carding. Prof. R. Chattopadhyay emphasized the importance of pre-carding processes, i.e., dry cleaning, washing, teasing, etc., to ensure the reliability of carding machine.



*Figure 6 Prof. R. Chattopadhyay presenting*

This presentation was followed by a demonstration of the carding machine developed by RuTAG IIT Delhi (Fig. 7). On April 23, 2022, around 45 herders and spinners attended the demonstration program of the carding machine (Fig. 8).



*Figure 7 Demonstration of carding machine developed by RuTAG IIT Delhi*



*Figure 8 Demonstration program for herders and spinners*

## 2.2 Presentation on carding machine

Harraj industries manufactured the carding machine designed by RuTAG IIT Delhi (Fig. 9). Mr. Harpreet Singh from Harraj Industries explained the manufacturing process involved in fabricating the carding machine (Fig. 10). He mentioned using standard materials and components in a machine whose spare parts were available in the market. The cost of the machine is ₹ 1.12 lakhs, including GST.



Figure 9 Fabricated Carding machine



Figure 10 Mr. Harpreet Singh presenting

## 2.3 Feedback on the new carding machine

Feedback on the new carding machine was presented by Mr. Pratap Chavda from Khamir and Mr. Shivlal Kulriya from Rangasutra. The following points were mentioned:

1. Yarn quality and spinning time of 20 gm of Patanwadi wool carded in the new machine was compared with wool carded in the Bikaner mill.
2. Mr. Pratap Chavda said that the quality of both the yarns were similar.
3. The spinning time of wool carded in the new machine was 5 -10 minutes more than the wool carded in the Bikaner mill. Mr. Pratap Chavda said that in the Bikaner mill, Patanwadi wool is mixed with longer staple length fiber. So, spinning is relatively faster.

4. Patanwadi wool was mixed with 30% long-staple length wool while carding in the new machine. The spinning time for this wool combination was the same as wool carded in the Bikaner mill.
5. The output of carded wool is around 50 to 55%. Prof. Rabi Chattopadhy suggested that the wool should be pre-cleaned before carding to get better outcome.
6. The quality of yarn produced by desi wool sent by Rangasutra was very much acceptable. The output of carding was around 70%.



Figure 11 Mr. Pratap Chavda presenting

### 3 Session 3A: Sharing regional experiences

#### 3.1 Presentations

Ms. Nisha Subramaniam from Kullvi Whims shared about the current scenario of *Desi* wool processing in various communities of Himachal Pradesh. *Desi*, *Gaddi*, *Rambouillet*, and *Pashmina* breeds of sheep are found in Kangra, Kullu Valley, Lahaul valley, and Ladhak. Ms. Nisha mentioned that there are just two shearers for shearing a large herd of sheep in the region, and the existing shearing process is not sustainable. In many places, traditional *kenchis* (*scissors*) are used for shearing. She also mentioned the difficulty faced in removing lanolin content from wool while washing. Also, an industrial carding machine is only available in Kullu and is far away for most herders and gets very busy during shearing season.

#### Required technology interventions

1. A low-cost shearing solution suitable for individual herders catering to 20-60 sheep.
2. Possibility of small wool washing machines.
3. Picker/ opener to open out the fibers and fluff it up.
4. Small carding machines.



Figure 12 Ms. Nisha Subramaniam sharing experience

Mr. Anand Ballabh Joshi, a technologist, and an ex-KVIC official, shared the scenario of women involved in hand spinning and weaving in various communities of Uttarakhand (Fig. 13). He narrated his journey of developing a drum carding machine for supporting women spinners of Uttarakhand. He suggested contacting Mr. Ram Kumar to get details of card clothing.



Figure 13 Mr. Anand Ballabh Joshi sharing his experience

Mr. Rajender Joshi shared a presentation (Fig. 14) on harnessing Himalayan plants to create sustainable natural dyes. He shared the contribution of Avani in the natural dying process.

### Required technology intervention

Need for low volume dye extraction machine.



Figure 14 Mr. Rajender Joshi sharing his presentation

Mr. Gopi founder of Dakhni dairies shared his experience of coarse wool scenario in the north Karnataka region in Belgaum and Bellary (Fig. 15). The population of sheep is around 10 million in Karnataka. Kurbas and Gollars are involved in the traditional occupation of rearing Deccani

sheep for their meat, wool, skin, and manure. Deccani wool is very coarse (fibre fineness 20 – 70 microns) and is used for making the blanket. Shearing of sheep is done twice a year. There is a ritual of celebrating the shearing of sheep. Scissors are used for shearing. The cost of shearing is more than the cost of extracted wool. NGO Dakhini Diaries procures 43000 kg of wool per year but the carding machine in the region is shut down.

### **Required technology interventions**

1. Need improvement of shearing scissors in terms of their ergonomics and life.
2. Need fully automated carding machine to card Deccani wool.



*Figure 15 Mr. Gopi Krishna sharing*

Mr. Vidyadhar Bhandare, co-founder of Earthen Tunes, shared his experience and challenges in processing Deccani wool by Kurbas in Telangana. He said that age-old metal scissor is widely used in local clusters for shearing the sheep. It is time-consuming and laborious, and multiple cuts result in shorter fibre length, and sheep sometimes get injured while shearing. The wool is mainly used for making blankets. The blanket as a product does not fall under the economic bracket.



*Figure 16 Mr. Vidyadhar Bhandare sharing experience and challenges in processing wool in Telangana*

### **Required Technology Interventions**

1. Needs a tool that makes shearing faster and economical and should be injury-free to sheep.

2. Need carding machine that does not break the fibres.
3. Need intervention in the entire value chain of wool processing.

Ms. Prerna Agarwal from Urmul Trust and Mr. Shivilal Kulriya from Rangasutra shared their experience and challenges in processing wool in Rajasthan (Fig. 17). Mainly Chokla and Marwadi sheep breeds are found in Rajasthan. The fibre fineness is around 38 microns. Ms. Prerna mentioned that three shearings are done in a year (March, July, and November). The rate of wool extracted in July is ₹ 80 – 160 per kg, while that extracted in November is only ₹ 30 – 60. Mr. Shivilal explained the process of washing sheep before shearing. Ms. Prerna mentioned the following challenges in processing the wool in the region:

1. The value chain is not defined appropriately, and there is a network issue.
2. Operation and the logistic cost are higher than the product cost.
3. Existing machinery for processing wool is not affordable.
4. There is a scarcity of water in the region.

### Required technology interventions

1. Need downscaled technologies for processing wool-like carding, pre-processing, and post-processing wool.



Figure 17 Mr. Shivilal and Ms. Prerna (not seen) sharing their experiences

Mr. Paresh Mangalia, Mr. Pratap Chavda from Khamir and Mr. Shamjibhai weaver from Kutch shared their experiences in wool processing and technical challenges in Gujarat (Fig. 18). In Gujarat Shearing is done in March and August of every year. The wool contains large amount of impurities in the form of dust and thrones and are very difficult to remove with existing processing facility available in the region. Due to impurities, a lot of wool get wasted while processing. Also, due to improper dyeing process the weaving time gets increased.

### Required Technology Interventions

1. Technology for softening of desi wool.
2. Technology for washing wool.
3. Technology and process improvement for dyeing.



Figure 18 Khamir presenting on desi wool processes

Mr. Sishir Tyagi from Wool Research Association (WRA) shared an overview of mandates, activities, and solution services provided by noted Wool Research Institutions of India.



Figure 19 Mr. Sishir Tyagi presenting on wool research activities in WRA

Prof. S. K. Saha shared few useful informations, they were:

1. For the sheep shearing project, possibilities could be explored to collaborate with NCUI to create SHGs. RuTAG IIT Delhi will provide technical support.
2. Course material can be prepared for training programs.
3. Introduction of IoT for marketing of products.
4. DSIR can help through TDUPW in funding women's skill development.
5. PRISM is another scheme of central government where proposals can be submitted.
6. NBCFDC can also be approached for funding.

#### **4 Session 3B: Training and demonstration of pottery kiln**

Training and demonstration of energy-efficient pottery kiln were organized in parallel at Mr. Ramzu Bhai Khumbhar's residence in Bhuj. Mr. Dipesh Buch welcomed all representatives from RuTAG IIT Delhi and participants from Agro Cell Industries, Kutch Kraft Collective, Shrujan Trust, LLDC, Khamir, designers, and potters of Kutch (Fig. 20).



*Figure 20 Mr. Dipesh Buch welcoming all the participants*

Prof. M. R. Ravi (Fig. 21) briefed about the specialty of the new kiln. He explained how the updraft kiln made using rat trap bond in brick masonry helps in reducing fuel consumption. Mr. Davinder Pal Singh explained the design details, method of construction, and firing process of the kiln. Later, Mr. Ramzu Bhai Kumbhar shared his experience of kiln construction.



*Figure 21 Prof. M. R. Ravi sharing details of Potter's kiln*

Mr. Ghatit Laheru from Khamir appreciated the efforts of RuTAG IIT Delhi and potters in coordinating the kiln construction and trial. Mr. Jitu Bhai Vada, former director of Gujarat Matikala Board, suggested a long-term collaboration between RuTAG IIT Delhi and Khamir. This will help potters get information about government schemes and support them for their better livelihood. The new kiln constructed in Bhuj was inaugurated, and feedback was taken from the potters. Potters suggested different sizes of kiln that can fulfill their firing requirements. Mr. Ramzu Bhai Kumbhar thanked all the guests and participants for spending their valuable time in the workshop (Fig. 22).



*Figure 22 Photographs from pottery kiln training and demonstration*

## **Day 2: April 26, 2022**

### **5 Field visits**

The participants who attended the wool processing workshop were divided into four groups, and the groups visited four different community clusters. The places visited were Vankar Valji Vishram, Bhujodi; Kharad weaver (Mr. Tejshi Bhai); Sanosara (to interact with herders as seen in Fig. 23), and NGO Hunnarshala.



*Figure 23 Visit to Sanosara to interact with herders*

Prof. M. R. Ravi and Mr. Davinder Pal Singh from RuTAG IIT Delhi visited pottery clusters in Anjar and Tuna. This visit was coordinated by Mr. Dipesh Buch from Khamir. Potters of Anjar use a rectangular kiln for baking toys (Fig. 24). They use ceramic tubes to make grids. The potters use high-temperature bricks for making the kiln since the temperature reaches more than 1100° C during firing. Wood bark is used as fuel which is very costly. Mr. Davinder Pal Singh introduced them to the rat-trap wall brick masonry technique, which helps in reducing fuel consumption.



*Figure 24 Visit to Anjar to interact with potters*

Mr. Rajak Bhai Kumbhar accompanied the team to Tuna, a cluster famous for making water pots (Fig. 25). Around 40-45 groups are involved in making these pots. They make 30-50 pots per day and fire about 250-300 pots at a time. They use huge pit kilns to fire the pots where waste materials like plastic, rags, and cloths as fuel.



*Figure 25 Visit to Tuna to interact with potters*

## 6 Session 4: Development of technologies for shearing, weaving, and felting Desi wool

Prof. S. K. Saha shared his journey of developing a sheep shearing device, carpet loom, carpet cleaning machine, and other tools for weaving (Fig. 26).



Figure 26 Prof. S. K. Saha presenting on technologies developed by IIT Delhi

On the other hand, Mr. Yogeshwar Kumar presented a felting machine developed by RuTAG IIT Roorkee. This presentation was followed by a real demonstration of the felting machine (Fig. 27).



Figure 27 Demonstration of the felting machine

At the end, Prof. Bhupinder Godara shared a recent design and development of a smart vending cart at IIT Delhi (Fig. 28).



Figure 28 Prof. Bhupinder Godara on vending cart

## 7 Session 5: Application of wool for building insulation

Mr. Mahavir Acharya (Fig. 29) presented the work of the Hunnarshala Foundation in utilizing desi wool for building insulation. Hunnarshala Foundation has developed prototypes and conducted experiments in various regions with varying climatic conditions across India to check the suitability of wool for building insulation. Mr. Mahavir Acharya emphasized developing a decentralized production system and standardization of desi wool products having applications in acoustic and thermal insulation.



Figure 29 Mr. Mahavir Acharya on wool in building insulation

### Required technology interventions

1. Product development & design for ceiling and wall panel
2. Check the acoustic property of the wool panel together with thermal insulation as a common product.
3. Design a carding machine to create layers and bind them with some synthetic fiber by melting process to make low-density sheets.
4. Design oven to get the required size and thickness of the low-density sheet.

## **8 Concluding remarks and future roadmap**

Prof. S. K. Saha coordinated the session. Prof. R. Chattopadhyay, Mr. Manoj Mishra, Ms. Sumita Ghosh, Mr. Sishir Tyagi, and Mr. Vidyadhar Bhandare were invited for the discussion. Prof. S. K. Saha mentioned that all the required technology interventions suggested by participants for several clusters would be analyzed. Interventions will be selected as per the mandate of the RuTAG program. RuTAG IIT Delhi will conduct field research for a detailed understanding of selected interventions.

The following points were mentioned during the concluding session:

1. RuTAG IIT Delhi will provide the required technical support in improving the processes (shearing, pre-cleaning, scouring, carding, spinning, dyeing, felting, etc.) and technologies for processing *Desi* wool.
2. RuTAG IIT Delhi and Hunnarshala foundation will work together to continue research on the application of *Desi* wool in thermal and acoustic insulation.
3. RuTAG IIT Delhi will conduct field research and make required modifications in the design of the kiln to suit firing requirements in Kutch.
4. Khamir has set a target of installing ten pottery kilns in Kutch.

## **9 Vote of thanks delivered**

Prof. M. R. Ravi and Ms. Gunjan Satija proposed a vote of thanks. Prof. M. R. Ravi thanked CfP and Khamir for hosting regional workshop in Bhuj. He thanked all the participating organizations for attending the workshop and providing valuable input. Ms. Gunjan Satija thanked RuTAG IIT Delhi for organizing the workshop. She thanked all the volunteers of the workshop for their contributions.

### **Acknowledgments**

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